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An Extract of Mr. Flamsteeds Letter of April, 19. 1673. containing some more accurate Observations of his own, about Jupiter's Transits near some Fixed Stars; useful for determining the Inclination of that Planet to the Ecliptique.

SIR,

THE inclosed Paper contains some Observations of *Jupiter*, which being made from a more convenient Station, than I commonly have used, are more accurate than my former ones: And, the Planet being in a fit place of his Orbit, they are the most useful for determining his *Inclination* to the *Ecliptique*, that we can again expect this six years, or perhaps before he returns again to this place. Had the Latitudes of the Fix'd Stars of *Tycho's* constitution been exact and coherent, we should easily have determined the *precise* quantity of this Inclination and those regular Inequalities we find in this and in all the other Planets, which are found irrepresentable by numbers, only by reason of some latent errors in the Places and Latitudes of the Fixed.

It would be a task deserving the pains and accuracy of the Learned *Cassini*, and of all others that have good Observatories and Instruments, to endeavour the Restoring of the Fix'd Stars, especially of those that are near the *Ecliptique*. Had I only a convenient place for observing, a ready Assistant, and other necessary accommodations, I should not doubt in a few nights to rectifie many of *Tycho's* errors; and to add some Stars to his Catalogue, as well visible to the bare eye, (yet omitted,) as Telescopical ones.

I have made lately some Observations of the utmost Elongations of the three Inmost *Satellites*; which I find greater than Signor *Cassini* states them, but almost the very same with Mr. *Townley's*. But I have just cause to suspect some Excentricity in the *third*; for I find (except I mistook in my measures, which, I think, I could not possibly do,) its Elongation greater on the one hand of *Jupiter* than on the other. I intend, at another opportunity, to make more Tryals as carefully as I can, either to confirm or destroy this observation.

F f f f f f 2

Ob-

Observationes ipsæ Joh. Flamstedii.

Quas tibi Jovis, prope Fixas transeuntis, observationes jam antea, Clarissime Oldenburgi, impertii, ejus in Tabulis motus fieri tardiores quàm in cœlis, (quod & Horroccio pridem suboluerat,) evidentissimè ostenderint: Latitudines etiam observata, minores semper supputatis, vel satis non promotum Nodi locum, vel justo latiore Plani orbitæ Jovialis inclinationem constitutam, videbantur innuere. Nodum, numeris Rudolphinis promotiorem cœlitus poni, à suis se observationibus reperire scribit Clar. Cassinus: Orbitæ minorem esse aliquantulum inclinationem ad Eclipticam, quàm statuit Keplerus (si Fixarum latitudinibus, in catalogo Tyconica exaratis, fideandum est,) ab observationibus infra descriptis ostendam.

Anno instanti 1673. Martii 13. st. Jul. vesperi, Jupiter Aphelius, pronus ad phasim Acronicam, & limitem orbitæ Boreum paululum transgressus, Retrogradus incessit versùs 9^{mo} m^o lucis 4^{te}, è qua (alto eo sex circiter gradus) limbi ejus remotissimi distantiam, septempedali tubo & micrometro Townleiano cæpi 4560 = 52' - 34".

Martii 17 die D^{na}, circa hora dimidiam post exortum Jovis, ejus, eodem tubo, limbi remotissimi à Fixa cepi iterum distantiam 2073 = 23' - 54".

Martii 20. die 4^{ta}, è loco multum commodiori, sequentes habui observationes. Primam breviori tubo, digitorum tantum 85, reliquas longiori, videl. 164. dig. V. Fig. 2.

	Fix. alt	hor. sup		Limbi. ph.	Centri.
1	6 — 0	7 — 14	Limbi 4 ^{te} remotioris à Fixa distantia —	8509	489 — 24
2	. . . .	. . . .	Eadem distantia tubo majori capta —	16509	529 — 28
3	14 — 40	8 — 16	Limbus 4 ^{te} infimus depressior ac fixa —	7844	414 — 17
4	15 — 40	8 — 23	Altitudinum eadem repetita differentia —	7864	414 — 17
5	. . . .	. . . .	Jovis diameter —	1350	48
6	16 — 25	8 — 29	Limborum iterum capta distantia —	16659	579 — 33
7	. . . .	. . . .	Denuo —	16589	549 — 30
8	19 — 00	8 — 50	Differentia altitudinum limbi 4 ^{te} & Fixa —	8385	004 — 36

Inde ad diem 26. nubes & pluvia, continua ferè, Jovis omnem observationem prohibuere; hujus tamen vesperi, cœlo præter spem factò sereno, alto 2^{te}. 15° - 40°, limbi sui remotioris à Fixa distantiam, eodem minori tubo, dimensus sum 4205 = 48'. 30".

Nocte etiam proximâ sequente, Jovem à Fixa plus remotum vidi; sed accuratè metiri distantiam, nubium, cœli locum subtercurrentium, spissities haud permisit;

Ad

Ad Planeta locum ex his annotationibus eliciendum, struſtis ſupputationibus, invenio

	hor.	^{h.}	¹⁶	hora	^{h.}	⁵⁰
Angulum parallacticum	34	44		37	30	
Centrum Ψ ^{vis} à Fixa diſtiti		9	28		9	39
Altitudinum differentia erat		4	17		4	36
Ergo, Angulus erat poſitionis	80	06		78	21	
Et Joviter in antecedentia Fixa		1	38		1	55
cum latitudine minori		9	19 $\frac{1}{2}$		9	18

Fixa mihi locus, accepto motu annuo 50", erit $\approx 13^{\circ} - 37' - 11''$; quem vult author Carolinus $13^{\circ} - 33' - 47''$; latitudo ejus Borea $1^{\circ} - 45'$: Locum ergo verus Jovis erit mihi,

Hora	^{h.}	¹⁶	⁰	³⁵	³³		Latitudo vera	¹	³⁵	^{40$\frac{1}{2}$}
	8	—	16	\approx	13	—		1	—	35
	8	—	50	\approx	13	—		1	—	35
					35	—				42.
					16					
					X ²	117.				X ¹ 1 $\frac{1}{2}$.

Jovis tunc locus in Ephemeride Heckeri eſt $\approx 13 - 22$, juſto minor, ſa-tem 14' min. Motus retrogradus eſt 8' min. Propterea ſcrupulis hora 34' reſceſſerit Planeta ſcrupulos ſecundos 11" fere; noſtra obſervatio dat 17"; quæ exigua differentia ejus præciſionem admodum commendat.

At Fixæ conſeſſo loco Carolino, prodibit Ψ locus $\approx 13^{\circ} - 32' - 09''$. qui ab iſtis Tabulis eruitur $13^{\circ} - 27' - 32''$, à cœlis ſuis deſiciens 4' - 37" latitudo ab iis ſupputata reperiatur $1^{\circ} - 37' - 21''$, cœlos exſuperans 1' - 41".

Loco ſic Planeta cum latitudine, & Tabularum à cœlis deviationibus perceptis, ne commodiſſima obſervationis ulteriorem ſummumq; fructum perdamus, Orbitæ Jovialis ad Terreſtris orbitæ Planum inclinationem inde eruerè conabimur.

Huic equidem inveniende, unâ cum loco Solis, ejusdem, Jovis, & Terra intermutuæ diſtantiæ poſtulantur: quas à Tabulis quibuſvis probatioribus tutiſſimè haurire licet: Ego Tabulis utor plerumque Carolinis; quippe quas, ut nonnunquam deviantes, cœlorum motibus propius annuentes, accuratiores, & faciliores cæteris omnibus comperi, ex quibus ad 8 h. — 16' p.m. deprompſi;

Solis locum verum ————— $\gamma 10^{\circ} - 40' - 18''$.

diſtantiâ à Terra ————— 100084

Jovis à Sole diſtantiâ ————— 544921

a Terra ————— 444952

ſam in appoſita figura 3. ſint, S Sol, T Terra, Ψ Planeta, S E Radius Eclipticæ, ad Ψ orbitam protenſa, & angulus $\Psi T S$, viſa Planeta à Terra Latitudo $1^{\circ} - 35' - 40''$.

Ex datis (in triangulo $\Psi S T$) angulo, $\Psi T S$, viſa latitudinis ad Circulum complemento; ΨS , & ΨT , Planeta à Sole & Terra diſtantiis, ut ſuprà, repertiſ, eruetur angulus $\Psi S E$, latitudo ſive Inclinatione Planeta à Sole conſpecta, 1 $\frac{1}{2}$. 18'. 7.

Jovis.

Jovis locus Geo-centricus erat $\approx 13^{\circ} 35' 33''$; ab iis ergò datis 4° & Terra à Sole distantis, invenietur locus Helio-centricus planæ $\approx 13^{\circ} 03' 33''$; è quo subdatis sigillatim iis nodi locis, quos auctores, quorum nomina in sequenti tabella exaravimus, assumpserunt, annexa produunt argumenta Latitudinis; è quibus videre est, nullis plus Jovem à limite promotum haberi quàm $6^{\circ} 29' 56''$, nec minus quàm $3^{\circ} 58' 59''$, quæ, quantavis videtur differentia, in maxima orbita inclinatione investienda, errorem scrupulis secundis $23''$ majorem inferre nequit.

Autbores	Loca	Argumenta latitudinis
Keplerus	$3-06-33-37$	$3-06-29-56$
Streetius	$3-06-33-47$	$3-06-29-46$
Wingius	$3-07-11-39$	$3-05-21-54$
Ricciolus	$3-07-18-00$	$3-05-45-33$
Cassinus	$3-08-45-00$	$3-04-18-33$
Bullialdus	$3-09-04-34$	$3-03-58-59$

ampli aliquantulum justo promotior videtur, magis tamen ceteris, variis de causis, placet: sumptis propterea, in Triangulo $4A\delta$, argumento latitudinis $\delta A 94^{\circ} 18' 33''$, & inclinatione $4A 1^{\circ} 18' 07''$, eruetur Angulus inclinationis plani orbitæ Jovialis ad Eclipticam $1^{\circ} 18' 20''$; quem statuunt Keplerus $1^{\circ} 19' 00''$, Streetius $1^{\circ} 20' 00''$, Bullialdus & Wingius $1^{\circ} 21' 48''$; omnes, justo nonnihil majorem. V. § 4.

Tantumque esse inclinationem, vel saltem non majorem, cum hesternæ noctis, tum Mensium Februarii, Martii & Maii Anni elapsi observationes suadent. Interea verò non dissimulandum, posse & majorem (scilicet $1^{\circ} 20' 20''$) à transitu 4° prope 8^{m} n^o, Anno 1649. Maii 29 & 30, St. Juliano, Bononiæ & Majorcæ à Ricciolo * &

* vid. Almag. Novum part. I. pag. 710.

Muto, viris doctissimis, observato, demonstrari: id quod nobis (si quidem orbitalium inclinationes ab omnibus invariabiles habentur,) videtur innuere, errorem vel huic, vel illis Fixarum latitudinibus à Tycho assignatis, inesse aliquem: quæ propterea donec accuratius restituantur, à præcisa hujus Inclinationis quantitate determinanda merito nos arcent: Hoc tantum, quoniam fixarum ea latitudines etiam immutabiles reperiuntur, ausim affirmare; Angulum maximæ inclinationis plani orbitæ Jovialis ad Eclipticam minorem esse scrupulis $26' 40''$ quam latitudo stellæ $9^{\text{æ}}$ lucis $4^{\text{æ}}$, quæ Tycho dicitur, ultima quatuor in sinistra ala Virginis: quæ propterea si quando correctæ dabitur, eadem certa dabitur inclinatio.

J.F.

Derbix, Apr. 16.
1673.